

TSG 5: Activities and programme for students with special needs

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Introduction

The program of this TSG focused on different groups of students with special needs such as learning disabled or mentally retarded students, deaf children or students with visual impairment. Moreover, different aspects were discussed: questions concerning the curriculum, different mathematical areas (e.g. numbers, measures or geometry), diagnostic procedures, and results or specific activities and programs for initiating adequate learning processes.

Session 1

The first two sessions emphasized aspects concerning students with learning disabilities. The first session started with *Olof Magne* and *Arne Engström* (Sweden) who presented their study »Middletown Mathematics«, in which the total inventory of mathematical achievement of approximately 2000 students was carried out in three successive investigations in 1977, 1986 and 2002 respectively. By making comparisons between the three populations of the respective age cohorts it was possible to assess the changes of achievement in the course of time related to changes of curriculum and the age of students. It was shown that the differences as to mathematical achievement between the three dates were mainly insignificant. One important result was that the students in upper grades achieved lower results on grade typical items than did students in lower grades. The researchers' interpretation of the study was that the school system produces students' difficulties in mathematics and that the quality of low ability group classrooms has to be improved.

The second presentation, given by *Philippa Bragg* (Australia) was titled »Measuring the Consequences. Teaching Linear Measurement to Students with Learning Difficulties«. Large-scale testing by the US National Assessment of Educational Progress (NAEP), TIMSS, and Basic Skills Testing, in New South Wales primary schools showed that large gaps remain in student understanding of measurement concepts. While these tests reported an overall improvement in the basic skills of measuring, many students seem unable to apply their knowledge to tasks that require a deeper understanding of the concepts. Philippa Bragg introduced two studies: The first examined students' skills and understanding of linear measurement skills in grades 1 to 5 with particular emphasis on those students who find learning mathematics difficult. The second study looked at students in grade 6 who had completed their instruction on measurement. Both studies found that most low-ability students did not understand the important concepts of linear measurement even though they were able to use a ruler correctly. Suggestions were made for an instructional methodology that will go some way towards helping



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TSG

Topic Study
Group 5

students learn important basic concepts about linear units and measurement. Getting a feel for usual household tasks may help forming a foundation for basic concepts.

Session 2

In the second session *Birgit Werner* (Germany) gave a talk titled »There is Something Wrong with the Hundred Square. Or: Observing and understanding mathematics classroom situations«. Based on the assumption that a situation in class is primarily one of interaction and communication, the understanding of communication turns into the main didactic and diagnostic issue. Thus, an adequate method of analysis for this situation becomes a necessity not limited to task fields of special-pedagogy. By means of a systems-theoretically oriented situation and communication analysis an instrument for paying attention to the moment of observation was introduced that answered both remedial-diagnostic as well as didactical-methodological questions. The observations of first, second and third order functioned as structuring devices, ultimately leading the way to a conclusion. Referring to these aspects *Birgit Werner* presented a case study, and concrete examples of activities with the hundred square were given.

Elisabeth Moser Opitz (Switzerland) went on with her presentation »Learning disabilities in grades 5 and 8: some results of a research project in Switzerland«. First of all, she referred to the many definitions that are used to describe children with learning difficulties in mathematics and the common sense that a major characteristic of learning disabilities in mathematics is falling behind the expected performance. She complained that most of the research does not describe more precisely what the nature of this falling behind is. Which are the specific competencies that the students are lacking? The project, carried out with 4000 children, addressed different questions: Which are the mathematical competencies of pupils with learning disabilities in mathematics in grade 5 and in grade 8? Is there empirical evidence that most pupils with learning disabilities in mathematics fail to understand basic arithmetical competencies like counting, place value concept, additive composition of number, efficient retrieval strategies etc.? Is there a difference in mathematical performance between pupils with learning disabilities in grade 5 and grade 8? Is there a difference in the attitude to mathematics between pupils with and without learning disabilities in mathematics? It was shown that students in higher grades failed in some basic competencies like counting or place-value.

Session 3

The third session started with *Ann Ahlberg* (Sweden) who spoke about »Children who are blind – Children with hearing impairment – Children without visual or hearing impairments – Experiencing numbers«. The overall aim of her study (in co-operation with researchers from Hungary and Norway) was to analyse the ways in which children handle and experience numbers. Three different groups of children – blind children, hearing impaired children, and children without these impairments – participated in the research. The main interest was to reveal the relations between the ways in which children handle numbers – their strategies – and their interpretation of meaning. The results showed that the children in all three groups handled and experienced numbers in various ways and that these were related to their sensuous and simultaneous experiences of the problem content. Some ways of handling were related to more than one way of experiencing numbers. The main findings in the comparative analyses showed



I C M E
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2 0 0 4

TSG

Topic Study
Group 5



I C M E
1 0
2 0 0 4

TSG

Topic Study
Group 5

that the sensuous experience of numbers to a great extent enables children to grasp numerosity, and that their simultaneous experience of different aspects of numbers contributed to their understanding. Furthermore it was shown that in spite of various sensuous experiences, children with visual or hearing impairment and children without these impairments are able to develop the same understanding of numbers on a group level.

The second presentation in this third session was given by *Akira Morimoto* (Japan) »On Mediation between Concrete and Abstract for the Hearing Impaired in Mathematics Classrooms«. The purpose of his study was to identify difficulties in mediating between concrete and abstract for the hearing impaired in mathematics classrooms. First, the framework was discussed in order to identify such students on the basis of the nature of perception in mathematics classrooms. According to this framework, two difficulties seemed to exist in mediating between concrete and abstract for the hearing impaired in mathematics classrooms. One is in seeing explicitly written mathematical symbols as a sequence of operations, not as a structure. The other is in selecting a category of concept and using a corresponding operation to make a structure in explicitly written symbols. Implications (e. g. discussing the individual perceptions more intensively) were drawn for communicating on mathematical idea in mathematics classrooms for the hearing impaired and the hearing.

Session 4

The final session started with the presentation »Accessible Math Technology for the Blind and Visually Impaired« given by *Susan Osterhaus* (USA). She gave an overview of the mathematical technology currently available, along with future projections, which should help teachers determine the most appropriate ways to teach their blind and visually impaired students and prepare them for success in the mathematics classroom, on standardized assessments, and in their chosen career. Various large displays, Braille characters, and talking scientific/graphing calculators were described, including their strengths and weaknesses. Moreover a variety of software and hardware products that assist in teaching math concepts or providing mathematical materials in an accessible format could be identified.

The last contribution »Math Education and Training for Autonomy in the Mentally Retarded Pupil« by *Antonella Montone* and *Michele Pertichino* (Italy) was presented by *Brunetto Piochi*. It was pointed out that a learning path addressing logic and mathematics for children with severe learning difficulties is often considered too difficult, or even impossible. Without denying or underestimating the hindrances, it was seen absolutely necessary to support the right of every child to learn as much as possible even in this field. Moreover, good mathematical knowledge is considered as an essential requirement to gain autonomy in life. In particular, the handling of relevant everyday and work place mathematics was discussed. During the talk some proposals for teaching and learning were given (e. g. to acquire a good knowledge of the concept of number, to be able to consult a calendar or a timetable; or to follow, show and draw paths). As personal autonomy represents an important achievement for every young person, the importance of the activities based on the methods presented was evident, since they are meaningful and useful to everybody.

In the four sessions of TSG 5 different aspects concerning mathematics education for students with special needs were illustrated. They provided evidence of the wide field of special education. Similarities as well as differences could be identified for the different groups of students. In the final discussion some key aspects concerning all different groups were pointed out:

- Future research concerning mathematics for students with special needs and empirical work should have a close connection to the didactics of mathematics.
- Research should combine theory and practice in a natural way so that the ideas and concepts may influence classroom practice.
- Some hypotheses about specific conditions for organizations supporting low achieving children were put forward, as for instance a change in the teachers' view of low achievers which may lead to a better understanding of individuals' thinking and learning.

This report has been written by Petra Scherer, University of Bielefeld, who will be happy to be contacted at petra.scherer@uni-bielefeld.de for further information on the work of this TSG.



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Topic Study
Group 5